Assessment of small-bore, dual-durometer aspiration tubing in a new dual-mode Phacoemulsification System

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BACKGROUND

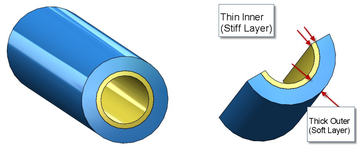
- Bench top studies have previously shown that the aspiration tubing ID affects pump pulsation and post-occlusion surge.
- This study conducted in a lab environment used a rigid chamber with pressure sensing to replicate occlusion and measure vacuum surge levels.
- A novel aspiration tubing design was evaluated with multilayer wall thickness with variations in the material durometer to reduce compliance of the tubing while maintaining flexibility and kink resistance.

PURPOSE

- Evaluate the performance of small-bore multilayer aspiration tubing in a new dual-pump phacoemulsification system on a benchtop setup for post-occlusion surge (POS).
- Evaluate peristaltic pump pulsation (PPP) to compare performance on different tubing designs on a benchtop setup.
- Present the venturi flow rate data using the new tubing configuration.

SMALL-BORE MULTILAYER ASP TUBING

Small diameter, two-layer PVC tubing with a soft outer thick wall and stiff inner thin wall was designed and extruded in two different configurations and used for testing on J&J dual-pump system.

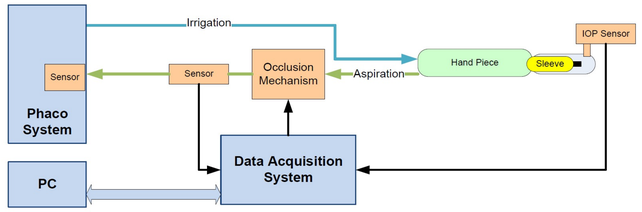


TESTING MATRIX FOR POS AND PPP

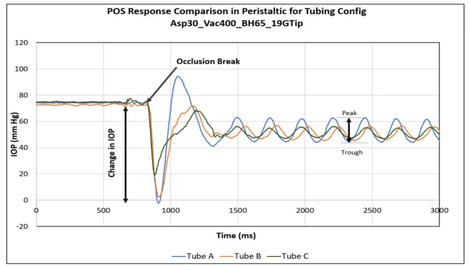
Sample Description	ID of the Asp. Tubing (mm)	Inner Layer Material	Inner Layer Thk. (mm)	Outer Layer Material	Outer Layer Thk. (mm)
Control -Single Wall Tubing (Material A)	1.21	N/A	N/A	PVC 70A (lower stiffness)	1.27
Tube Material B	1.21	PVC 90A (higher stiffness)	0.43	PVC 50A	0.84
Tube Material C	1.21	PVC 98A (highest stiffness)	0.43	PVC 50A	0.84

TEST SET UP DIAGRAM

Block Diagram – Fluidics Test Fixture



POS CURVE ON PREDICATE SYSTEM TUBING DESIGNS



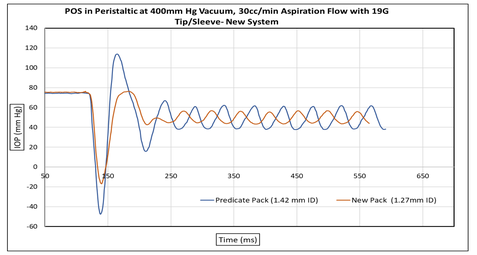
Reduced POS and PPP (peak to trough) with stiffer layer tubing

POS RESULT SUMMARY-TUBING DESIGNS

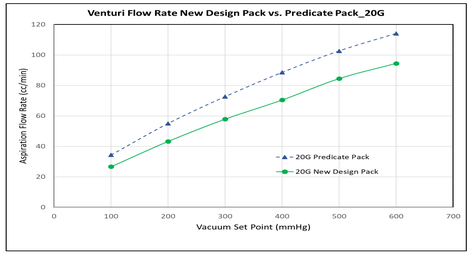
Tube Type	Delta IOP –Surge (mm Hg)							
	1	2	3	4	5	6	Avg	% Change
Tube A	77.4	94.6	76.4	82.3	79.8	82.4	82.2	N/A
Tube B	71.5	64.9	70.7	71.0	71.5	71.6	70.2	14.5
Tube C	53.1	51.9	55.6	50.5	50.7	55.6	52.9	35.6

Improvements as high as 35% with multilayer stiff construction

POS CURVE-PREDICATE PACK& DESIGN PACK



VENTURI MODE FLOW RATE_20G



Reduced POS and PPP (peak to trough) on new design compared to predicate pack

CONCLUSIONS

- Using multilayer tubing design for aspiration tubing with stiff inner layer reduces POS and PPP in a benchtop study.
- With small-bore tubing, the Venturi flow rates are more controlled at higher vacuum while still achieving good balance of holdability and followability.

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